

**TRANSFORMING AND GREENING TVET FOR SUSTAINABLE DEVELOPMENT
IN WESTERN KENYA**

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ABSTRACT

In an age characterized by global economic crisis and climatic change crisis, Green Technology(GT) aspires to tackle the challenges of; encouraging development and poverty reduction, creating new and more vibrant economies based on clean technologies and securing an increasingly greener world. This is a paradigm shift. The need for green technologies and investment ultimately takes a pertinent agenda in this century. Globally, cities account for about 70% of CO₂ emissions, which comprise a significant share of global greenhouse gas emissions, the bulk of these being generated in the building and construction, urban transport, and energy sectors. The global challenge we face today is that of preventing catastrophic climate change. This prevention requires a multidimensional approaching including education and training. For most developing countries, the ability to nurture the transfer of green technologies by building technical capacities and by creating institutional framework for adaption and improvement is a big challenge. Generally green technology is more expensive than the technology it aims to replace because it accounts for environmental costs. According to Luke and Rompaey(2008), the likely barriers to green technology include; lack of human resources and skill, lack of information, high implementation costs and unknown alternative process technology. TVET institutions with mandate for technical training will require a paradigm shift to meet these challenges. This paper seeks to find out the status of green technologies and green skills in technical Training Institutes in Western Kenya. Research methodology used was quantitative while research design adopted was survey research design. The findings from the study indicate that majority of TVET courses offered do not integrate GT in training; Students and staff should be involved more on Green Technology project and that TVET institutions should strengthen their linkage and networking programmes in the area of GT.

Keywords: TVET, Sustainable development, green skills and technologies, green economy.

INTRODUCTION

Changes in physical environment such as global warming, changing weather patterns, floods, drought, rising sea levels and scarcity of natural resources require adaptation measures. These changes are being felt all over the world especially where sustainable development is compromised. Sustainable development is defined as development which meets the needs of present generations without compromising the ability of future generations to meet their own needs. Human populations are obliged to change their production patterns to cope with changes in physical environment of planet Earth. A global green technological transformation greater in scale and achievable in short time is required. Green Technology(GT) is a method of practical application of knowledge from environmental science to conserve the natural environment and resources in harmony with mother nature and ecology. GT intends to improve the Kenyan economy without harming the environment. It is a new development paradigm that creates new growth engines. These green transformation in the economy also known as greening the economy will ultimately affect skill needs and consequently the training needs. Green transformation shifts activities in the economy from those that are less

energy efficient and generate higher CO₂ emissions to those that are less polluting. This shift at the industry level is causing structural shifts in employment between and within industry. The green restructuring in turn decreases demand for some occupations and skill profiles and increases demand for others. The growth of alternative and renewable energy sources such as wind and solar is a classical case of emerging occupations. This growth calls for training and “upskilling” to enable workers and enterprise to move from declining to growing sectors and occupations.

Statement of the problem

Development in Africa in the past has been associated with environmental degradation and lack of consideration for sustainability. African economies lack rapid growth and has a workforce that is not yet fully empowered with knowledge and competency skills required for and by industry. Lack of Competencies in green skills continue to be the major cause of unemployment among women and youth and further cause environmental disharmony. As the world prepares to shift into the green economy, Africa is again just about to be left behind. The low skill level among TVET instructors on green technology and lack of green technologies and green skills appear to be the hall mark of TVET training system. This paper seeks to find out the status of green technologies and green skills on offer for youth and women in technical Training Institutes in Western Kenya as a genesis towards green growth.

LITERATURE REVIEW

GT as a friendly solution aims at reducing environmental damage created by products and technologies for human conveniences. It promises to increase farm profitability while reducing environmental degradation and conserving natural resources, provide cheap renewable energy from wind, sun, sea tides and waves, biogas and biofuels. Such application of products, equipment and systems are used to conserve the natural environment and resources. This will minimize the impacts of human activities on the environment. This technology is needed across all sectors. Sustainable development is a requirement for survival of humans. Green investments, particularly in renewable energy and ecoconstruction, are potentially significant engines for job creation (Innovas, 2009). Structural changes, the introduction of new regulations and development of new technologies and practices result in emergence of new occupations. This may be country specific. For example Kenya has the National Environmental Management (NEMA) Act, 2012 that gives strong emphasis on sound environmental management systems. This implies that government’s action to reduce damage to the environment and health is often a prerequisite for developing markets for greener technologies and services (EU, 2010). There is a call for the provision of relevant training courses and adjustment of qualifications and training system (Makowe, 2009). The extent to which technical training institutes have provided relevant training courses, established and followed new regulations and developed new technologies is not known. New skills will be needed by workers in current occupations and industries in the process of greening existing jobs. A green job is defined as a job that reduces the environmental impact of enterprises and economic sectors, ultimately to levels that are sustainable. This definition covers agriculture, industry and biogas. Emerging professions, service and administration that contributes to the preservation or restoration of the quality of the environment while also meeting the requirements for decent work - adequate salary, safe conditions, worker’s rights, social dialogue and social protection and security. It also covers activities related to both mitigation of, and adaptation to climate change. This implies that every job can become green. For example within automotive industry jobs from engineering, design to the

assembly line will have to do with new fuel efficient technologies, farmer's will have to adjust to either severe drought conditions requiring them to learn how to grow new crops or new methods to produce the same crops under heavy rain conditions. Rural communities will have to learn to live in flats that are well planned and free more land for agriculture. This calls for efforts to revise existing curricula qualification standards and training programs at all levels of education and training. This assertion confirms that skills development responses ought to be prioritized in favour of building on existing skills sets, as well as improving the generic skills of people across the entire workforce

GT and the Economy

The transformation to greener economies provides a chance to reduce social inequalities. Social justice requires that training initiatives target those who lose out jobs during the transition especially those who are disadvantaged in the labor market and require assistance. The green benefit in the economy will be achieved only if access to new training as part of the green measure is made available and accessible to the disadvantaged youth, women, persons with disabilities, rural communities and the aged (Unep, 1997; Hansmann, 2010). Incentives to increase youth and women participation in technical training programs will not only increase their participation in technology driven occupations but will also to solve skill shortage in the labor market. The extent of the changes already here and those anticipated depends on the technology and market demands in the green transformation. Preparation for new occupations or the growth of new occupations or the growth in demand for others at expense of others is vital for preparing young people for the labor market (Unep, 2011). Workers already in the labor market will need access to retraining programs to enable them and enterprises move from declining industries and occupations into growing ones and keep their skills to date with new technology, market demand and government regulations in their fields of work.

Green growth is a way to pursue economic growth and development, while preventing environmental degradation, biodiversity loss and unsustainable natural resource use (OECD, 2010; Unep, 2011) It's however noted that green economy activities and technologies are likely to increase the employment demand, but will not lead to significant changes in the work and worker requirements. There is growing concern about the environmental unsustainability of past and current economic growth patterns and the risk of irreversibly altering the environmental base needed to sustain economic prosperity (OECD, 2010; Cedefop(2009).

TVET Training in GT

The formulation of policies that could support greening of TVET institutions through the development of Green Campus, Green Technology, Green Community, Green Research and Green Culture had been strongly recommended (OECD, 2011; World Bank 2012b)). A model policy framework for greening TVET was proposed highlighting six major policies with the strategies, actions and indicators to be used. These policies include (1) development of a TVET Protocol, (2) creation of a Green TVET fund, (3) formulation of an HRD Plan for TVET, (4) identification of Core areas in Green Technology, (5) development of Green Curriculum in TVET, and the (6) strengthening of green Research and Development initiatives. In light of the greening of economy, green occupations priority areas that TVET can focus on, include engineering technician, construction technician, organic agriculture technician and power generation technician (solar, wind,

biogas and hydro) among others (African Development Bank Group, 2012). Structural changes for student curriculum seem to be of urgent priority based on localized needs, job analysis, adherence to national and international standards and work-based learning. These changes need to have components of generic and green entrepreneurship skills and recognition of prior skills from the workplace. Teacher training curriculum have to be industry immersed with capacity building and support from industry. This transformation can only be realized through networking as a platform to support proposed strategies. Since new technologies appears as a common need for all the segments, international, regional, national and industry-based networking are needed, while institutional networking would benefit the process of building capacity in thematic areas. Training on green skills must ensure matching green jobs that can absorb them. There shouldn't be any gap between education and jobs, in cases when countries' labor market is not fully prepared for green development.

Women and Youth Participation in GT

Disparities in education and development have led to the exploitation of natural resources, indigenous people, women and children (Boyden, Ling & Myers, 1998; Limoncelli, 2010). For example, it can be argued that pollution and the Greenhouse Effect are global ramifications of progress (Bodley, 1998), with particularly harsh effects on developing countries. Research by Cornell University (2007) showed that pollution causes 40% of deaths worldwide, especially in developing and underdeveloped communities in Africa and Asia. The continuing struggle for natural resources has led to destruction of the rainforest (Greenpeace, 2011) and population displacement (UNESCO, 2011).

Women are also under represented in science and technical subjects at schools on the secondary or tertiary level. Green jobs also need to be decent jobs, meaning they have to respect workers' rights, pay decent salaries, offer job security, safety and humane working conditions etc. The green economy also needs to comply with minimum standards for employment. A job that exploits workers or does not allow the employee to make a living cannot be called green. Additionally, many of these jobs that are needed in a green economy can be covered by already existing jobs. Integrating green skills in a reliable data collection of green skills poses a considerable global challenge to occupational and industrial classification systems. As a consequence, forecasting of green skill needs employment trends and corresponding skill requirements. Countries that have a long track record of well-established and refined labour market information systems have advantages. However, they still need to adjust to the new skill requirements of the low-carbon economy. Countries that don't have such procedures rely on ad-hoc surveys and initiatives supported by donor countries which often remain one-time events and are not sustainable. The ILO-CEDEFOP study points out that the most effective approaches for "anticipating and monitoring needs for green skills are those that are built on social dialogue at sectoral or grass-roots level". The report also emphasises that there is a need for greater coordination across economic sectors (ILO, 2011).

Status of GT in TVET Institutions

The International Consultation Meeting of 2011 in Bonn called for green qualification linking the economy to adequate employment opportunity creation (UNESCO, 2011). However, this can only be accomplished if TVET and the economy are closely linked. With this background, it is thus not surprising if TVET systems are facing greater challenges than

workplace-related programmes. Apart from that, basic green skills required for different variations of specific occupations can be determined in practically all cases, even without analyzing education needs in detail. This entails knowledge, skills and abilities in the context of energy and resource efficiency, avoiding waste and waste management, knowing about the potential environmental impact of a respective occupational activity as well as knowing means to avoid risks by acting adequately in a work-related context, and finally, the ability and willingness to take on producer responsibility for one's own actions within the boundaries set by the employer or line manager. Strategies, programmes and measures for environmental and resource protection can only be carried out if a sufficient number of employees with the required skills are available to develop, install and operate environmentally friendly and effective technologies and processes. A shortage of skilled labour represents a serious barrier to the introduction of green technologies in many countries. As a consequence, the potential for climate protection cannot be fully utilized. Thus, building standards for passive or low energy houses are often not met, and facilities for renewable energies cannot be maintained or repaired properly (UNEP, 2011).

If TVET is given a key role in the context of green economy and sustainable development, then extensive demands will be made of state and private TVET institutions. It is here at environmental and resource micro level of training programmes that the principles and concepts of sustainability protection are core tasks for development. Here it would be shown through practice qualifying vocational schools which competences have to be promoted and trained among young people (but also older people) in order for them to be able to make professional contributions to societal transformation – or not (World Bank, 2012b). Sustainable development, environmental and resource protection would become core concentrations of qualifying vocational schools. They would become much more than an added on, temporary issue which is left to isolated committed teachers and trainers or which is given attention only on the periphery through individual projects (Africa Development Bank Report, 2012). However, Curricula and alignment to greening TVET, capacity building, facilities and infrastructures (equipment, devices and laboratory) and the integration of different training institutions and strengthening of coordination remain to be the challenges observed in the education sector. In the industry sector, (1) awareness on green technology, (2) lack of green technology and (3) tax incentives schemes are among the issues expected to be confronted in taking this direction.

RESEARCH METHODOLOGY

The study used quantitative research methodology

Research Design

This study adopted survey research design. Face to face interviews were conducted with managers of selected TVET institutions

Study Area

The researchers conducted the study in Kakamega county in Western Kenya. The county has a number of TVET institutions among them, Sigagala Polytechnic, Shamberere T.T.I, Bushangala T.T.I, Bukura Institute of Agriculture, Kisiwa T.T.T, Kaimosi T.T.I, Matili T.T.I and a host of private institutions offering Technical and vocational training.

Target population

The study was conducted in Kakamega county, western Kenya. The target population for this study included students, staff and managers in TVET institutions in this county. The target population

FINDINGS

Independent Samples Test									
Items of analysis	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	Mean Rating by staff N ₂ =29	Mean rating by students N ₂ =225	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Students and staff are knowledgeable about types of green skills in TVET institutions	8.02	.087	3.11	2.97	-1.82	224	.270	0.14	.132
Courses offered in training institutions entail green technology	13.065	.061	3.03	2.43	1.036	224	.021	0.6	.1356
Students and staff are knowledgeable about policies and practices that support GT?	10.596	.093	2.64	2.53	-7.50	224	.170	0.11	.1159
Students and staff have practical involvement on Green Technology projects	7.419	.077	3.26	1.84	-2.54	224	.012	1.42	.1323
Training institutions organize forums for stakeholders, making them aware of GTVET	6.531	.092	2.96	1.89	1.036	224	.007	1.07	.1243
TVET institutions enhance collaboration and networking among GTVET practitioners	4.67	.070	3.37	2.76	-1.72	224	.301	0.61	.1321

Status of green technology in TVET institutions in Western Kenya

The research sought to find out the ratings by students and staff on status of green technologies and green skills on offer for youth and women in TVET institutions. This was informed by the fact that; the role of the teachers appears to change from knowledge transmitter to that of facilitator, knowledge navigator and sometime as co-learner and that learners have more responsibilities of their own learning as they seek out, find, synthesize, and share their knowledge with others. An item-by-item independent t-test was carried out to determine whether items were significantly different at ($\alpha = 0.05$) in the ratings of respondents regarding the status of green technology in TVET institutions in Western Kenya. Due to large disparity in the sample sizes of the group, ($n_1 = 25$, $n_2 = 125$), the t-test was preceded by Levene's Test for Equality of Variances to test for homogeneity of variance. If the significance level is greater than 0.05, then you assume that the population variances are relatively equal, however, for a value less than 0.05 indicates that the variances are unequal. The results as shown in the table indicated that the variances of this group for each of the items were homogeneous.

On the question whether students and staff were knowledgeable about types of green skills and green technologies in TVET institutions, the findings showed that both respondents had a mean rating greater than 2.5. A p-value of $0.270 > 0.05$ indicates that the difference in means were not statistically different. There is a general consensus that both staff and students are knowledgeable about the type of green skills and green technologies offered in TVET institutions. Among the green technology skills and projects that students could easily state include; solar energy, organic farming, tree planting and biogas. It was however noted through interview that few students had never come across the term 'green technology'. On the question whether courses offered in training institutions entail green technology, the findings showed that staff had a higher mean rating of 3.03 while students' rating was 2.43. The t-test value of $0.021 < 0.05$ indicates that the mean ratings of both students and staff were statistically different at 95% confidence level. This finding shows that TVET courses in western region of Kenya do not fully entail green technology. This finding confirms with the interview schedule results with managers who said that the lack of GT in the syllabus had forced them to organize for workshops and seminars on green technology in order to update lecturers on the modern trends in this field. Knowledge about policies that support green technology by both staff and students elicited a p-value of $0.0170 > 0.05$ at 95% level of confidence. This results show that the mean ratings were not significantly different and indication that perhaps TVET institutions have made strides in sensitizing students on green technology. This sensitization however is not reflected in the practical approach to green technology perhaps due to low funding of green technology in these institutions.

Respondents were asked to give their opinion on whether students and staff get practical involvement in green technology projects. The mean ratings of were 3.26 and 1.84 for staff and students respectively. The t-test value of $0.012 < 0.05$ indicates that the difference in the mean ratings were significant. It may be suffice to argue that TVET institutions have allocated some of their resources towards training of staff in green technology. Lack of, or inadequacy of funds may be the major reason why students do not have practical involvement in green technology projects. This results concur with the next question on whether college management organizes workshops that promote GTVET for sustainable development. This was indicated by a staff mean rating of 3.37 while student mean ratings was at 2.12. It can be observed that college management seem to be keen of staff development on green technology perhaps because this is a new concept in the TVET curriculum. Being a relatively

new concept, workshops seem to favour teaching staff more than students. It's no wonder that the mean rating of students respondents was low.

Responses on whether training institutions organize forums for stakeholders to make them aware of greening TVET, the findings showed that the mean ratings were significantly different (p -value of $0.007 < 0.05$). this is quite a concern since TVET institutions are expected to be outgoing in terms of courses they offer and how such courses should be deemed relevant by the community at large. Practitioners in building industry, local farmers, manufacturers and county leadership should be able to feel the impact of green technology being implemented at the institutional level. More importantly, TVET institutions should be seen on the lead, advocating for and implementing more environmentally friendly technologies. To this end, a more concerted effort to involve the local/devolved government the national government and the private sector in training and funding in green technology should be seen as an intelligent strategy.

Lastly, the researcher sought to establish whether TVET institutions enhance collaboration and networking among GTVET practitioners within and outside the education system. The mean ratings were 3.37 and 2.76 for staff and students respectively. At-test value of $0.301 > 0.05$ indicates that the ratings were not significantly different at 95% confidence level. There in a general consensus by both staff and students that TVET institutions have gone out of there normal schedules to get involved deeper with other relevant institutions and bodies in their training systems. This drive towards collaboration and networking is aimed at ensuring that the quality of education is sustained while ensuring that both staff and students get latest and modern skills that are required in the industry.

RECOMMENDATIONS AND CONCLUSION

Arising from the findings, its noted that although both staff and students have knowledge on green skill and technology, the practical application of this knowledge has not been fully utilized. One of the reasons perhaps would be the low level of funding for renewable energy skills as well as low skill level by TVET staff. It worth to note that the staff training on renewable energy and other green technologies should be seen a great leap forward in this direction. However, great emphasis has been placed on college management and the government to invest deeply on green technology because of its social benefits and more importantly a sustainable environment. Great efforts should now turn the tides towards transferring the green technology skill to students who can implement this technology in their present and future employment. Any variation in skill gap between students and teaching staff should be seen as a positive challenge for staff to make more training in green technology and more importantly, a department of research and development on green technology should be welcome as a more towards green institutions, green clubs green buildings and finally a green economy for Africa.

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